Comments of the Society of Broadcast Engineers, Inc.

ET Docket 95-18
Allocation of 2 GHz Spectrum for Use by the Mobile-Satellite Service

Opposition to Petition for Partial Reconsideration

June 17, 1997

SOCIETY OF BROADCAST ENGINEERS, INC.
Indianapolis, Indiana

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Section 2.106 of the	)	ET Docket No. 95-18
Commission's Rules to Allocate	)	Opposition to Petition for
Spectrum at 2 GHz for Use by	)	Partial Reconsideration
the Mobile-Satellite Service	)	

To: The Commission

Comments of the Society of Broadcast Engineers, Inc.

The Society of Broadcast Engineers, Incorporated ("SBE"), the national association of broadcast engineers and technical communications professionals, with more than 5,000 members in the United States, hereby respectfully submits its Opposition to the Petition for Partial Reconsideration filed by the "MSS Coalition."

I. No Reconsideration is Necessary or Appropriate

1. On May 20, 1997, the MSS Coalition* filed a 60-page Petition for Partial Reconsideration to the March 14, 1997, First Report and Order and Further Notice of Proposed Rule Making to MM Docket 95-18. SBE disagrees with many of the claims made in that Petition and urges the Commission to dismiss the filing.

Necessity of Continued Use of FM Video BAS Operations

2. The MSS Coalition claims that the Commission made its decision to restore 20 MHz of the 35 MHz being re-allocated to MSS on an inadequate record, and argues that broadcasters can make more efficient use of even less Broadcast Auxiliary Services ("BAS") spectrum by implementing more spectrum-efficient digital modulation techniques. SBE can only conclude that the MSS Coalition either did not read, or is purposely ignoring, the detailed comments of SBE, and others, explaining the numerous technical reasons why conversion from FM video analog transmissions to digital transmissions cannot yet occur: size, weight, and power consumption restraints for portable and mobile transmitters; issues of contribution quality; latency problems; and, for now, the high cost, and limited availability, of digital codecs and

* Comprised of Comsat Corporation; Hughes Space and Communications International; ICO Global Communications; and Personal Communications Satellite Corporation.

demodulators. For the MSS Coalition to claim that the record did not adequately support the Commission's decision is simply incorrect.

3. The facts are that digital technology is not always appropriate, that it is not necessarily more spectrum efficient than analog, that contribution quality must often be far better than the MSS Coalition would like to admit (thus requiring more bandwidth), that existing digital equipment is not adequate for many circumstances, that the time delay inherent in "heavy" digital compression can be embarrassing, and that analyses of electronic news gathering ("ENG") paths based on satellite models are incomplete and wrong. The requirements which would be placed on BAS links by the MSS Coalition proposals would necessarily result in loss of true mobile camera capability and in "advanced digital" pictures significantly worse than today's analog pictures.

4. The Petition brings no new facts to light; rather, it is an attempt to ignore inconvenient facts by restricting the discussion. The FCC made a reasoned decision which is already sufficiently damaging to the Television industry. If MSS cannot come into existence without destroying live television coverage of fast-moving news and sports events, which are currently relied upon by virtually every U.S. citizen and voter, under today's picture quality standards let alone future quality requirements, then MSS should not exist.

5. The MSS Coalition acknowledges that there is scarcity of BAS spectrum in the top-25 broadcast markets, but claims that the record does not prove that there is similar scarcity in the remaining nearly 200 smaller broadcast markets. Yet, because MSS will be a nation-wide service, lack of available spectrum in the top-25 markets, in and of itself, is sufficient to establish broadcasters' need for the 20-MHz partial replacement spectrum at 2,110–2,130 MHz. Thus, the MSS Coalition's own comments demonstrate the need for 105 MHz of BAS spectrum at 2 GHz.

6. An issue not even discussed in the Petition is how many additional users have been added to BAS spectrum in approximately the last ten years with no additional spectrum allocations being made. The 2 GHz BAS spectrum was formerly used only by television stations and by broadcast networks operating through their owned stations. The cable systems and cable networks were made eligible, as broadcast networks were made eligible.** No new spectrum was allocated to accommodate CNN or ESPN. No new spectrum was allocated to accommodate Fox, UPN, WB, local cable news channels, or

** Third Report & Order to General Docket No. 82-334, released February 23, 1987.

MMDS. In short, there are now more simultaneous users in many markets than there are channels, and real--time frequency coordination has become a daunting task. The situation is exacerbated when a news or sporting event of national importance occurs, such as the Oklahoma City bombing and trial, and out-of-town users descent upon the local market. Yet broadcasters have, so far, been able to continue to operate with no additional channels, often by doubling up and re-using channels in inventive ways (*e.g.*, cross-polarization, where receive power ratios permit; this is more difficult than for satellite transmissions). As broadcasters' sharing options decrease, their need for more channels becomes greater. And, let us not forget, that it is not only over-the-air television which is affected by 2 GHz BAS congestion, but cable users as well.

7. Contrary to the claim that the Commission's decision was "arbitrary and capricious," the decision reached in the First Report and Order was well documented. The reality is that the MSS Coalition wants a "free ride" in the form of lucrative new spectrum, but without having to pay the cost of first clearing 2,110–2,130 MHz of existing point-to-point fixed Private Operational Fixed Service (POFS) links, and then reimbursing broadcasters for their costs in modifying BAS equipment to operate in the shifted band.

The DTV Decision Does Not Undermine the MSS Decision

8. The MSS Coalition argues that the recent Fifth and Six Report and Orders to MM Docket 87-268, concerning Digital Television ("DTV"), coming "less than three weeks" after the MSS Report and FNPRM, somehow invalidates that Order. SBE disagrees. First, the DTV Orders were long expected, and the adoption of the Grand Alliance DTV standard and a final table of DTV Allotments was hardly a surprise. Second, the DTV Orders are designed to provide a final link transmission path to viewers, whereas digital modulation techniques used by BAS must be of contribution quality, so as to withstand subsequent editing and re-processing. Therefore, the MSS comparison is not valid, and there was no "abuse of discretion" by the Commission, as alleged by the MSS Coalition.

9. Digitizing an analog signal automatically increases drastically the bandwidth required to transmit the signal because the digital signal has more components (bits per sample) to transmit than the original analog signal from which it was derived. The only way to reduce the bandwidth is through digital compression, which "throws away" redundant samples. Lossless compression, such as used for computer programs, allows the original signal to be reproduced exactly upon re-expansion. However, lossless compression does not "throw away" enough samples to reduce the bandwidth significantly. Lossy compression throws

away more samples, using algorithms to determine which samples are less likely to be missed. A still picture does not change from frame to frame and so can basically be transmitted once and retransmitted only often enough to deal with receivers newly tuning to the channel after the original compression. Pictures with little motion, such as "talking heads," change little from frame to frame, and may therefore be heavily compressed. But pictures with large amounts of motion, such as pictures of objects tossed by gale-force winds, need much more bandwidth for transmission of all the motion data. Sporting events also tend to feature rapid motion. But manufacturers seeking to make a point about how little bandwidth can be used will not choose high-motion pictures to demonstrate because those pictures will not make their point.

10. At least one major network, ABC, Inc., has developed a series of tests to see how well digital compression systems work under typical high-motion conditions, such as are often found in network programming, and has found the Comsat estimates, reused in the Petition, grossly inadequate. See the ABC Engineering Statement attached to the Joint Comments of AMST, etc., filed May 17, 1996, in this proceeding. The reason existing compression equipment has worked well to date is that it has not been stressed. The Comsat-Wegener DV2000,‡ touted by the MSS Coalition (at Page 14, Note 40, and at Exhibit A, Page 7) failed the ABC laboratory tests.

11. How far a picture can be compressed also depends upon what will be done with it. If a picture is to be compressed only once and kept compressed through distribution, significant compression is possible. For example, if a news segment is produced completely at an satellite news gathering ("SNG") truck and transmitted directly to a station for transmission to the public, the only problems will occur getting into, and out of, the piece. But when shots from a portable camera are to be integrated into a program, which is then relayed to a network and on to a local station or cable system, the picture must be uncompressed and recompressed a number of times to permit editing such as camera cuts, captions, supers, effects, *etc.*, to be added.

12. The MSS Coalition's Exhibit A neatly ducks this issue by talking about conditions "in the absence of a scene cut," ignoring that cameras in field productions are cut as often as every few seconds. If some of the cameras are radio-frequency ("RF") cameras and must be digitally compressed for transmission back to the field truck, the signal must be uncompressed at the truck to allow cuts to occur. Most editing will be done at the field truck,

‡ DV2000 is the production name of the prototype unit tested and reported on by ABC.

but inserts must also be done at the network and at the affiliated station. If the picture is initially highly compressed at the RF camera, then must suffer up to three more compression/decompression cycles (field-to-network, network-to-station, and station-to-viewer), the artifacts created by the multiple lossy compression cycles can become ugly, depending upon how hard the signal was compressed at each step.

13. The MSS Coalition's claims that digital pictures transmit better without degradations is only true when only a single compression occurs, which is typical of today's mostly analog system but will not be the case for many, if not most, digital systems. These problems are not yet obvious to all, because sequential hard compressions are not yet needed, but they will be in an all-digital system; and there is a vast difference in the artifacts created by compression to 45 Mb/s (standard DS3), to 22 Mb/s (the lowest currently recommended by ABC for video with motion), and to 12 Mb/s or below (recommended by the MSS Coalition).

14. The two digital tape formats that are gaining industry acceptance are the Sony Betacam SX and the Panasonic DVCPRO. SBE understands that CBS and NBC have each invested on the order of $20 million on these devices. However, neither the Sony or Panasonic recorders compress video below 18.6 Mb/s. And, when audio and error correction are added, the combined data rate approaches 22 Mb/s. This compression is not so severe that several sequential compression/de-compression cycles cannot be tolerated.

15. As of this writing, there is no way to handle editing without decompressing and recompressing. This means that the initial compression must be gentle enough to avoid creation of significant artifacts, which is the purpose of "contribution quality." The MSS Coalition has confused contribution quality with distribution quality, which would result in digital pictures being significantly poorer than provided by today's analog systems. Contribution quality requires a significantly higher bit rate, which requires much more bandwidth. Claims of a "contribution quality signal in channels of 12 MHz or less" (Petition at Page 13, and again at Page 3 of Exhibit A) are simply wrong (as proven by the ABC Laboratory). These signals are not true contribution quality, nor are they pictures containing significant motion. They are distribution quality only.

16. True contribution quality for digital NTSC requires more like at least 22 MHz of bandwidth (again, refer to the ABC Laboratory report). This is somewhat greater than the present FM video analog bandwidth. If a way is developed to do scene and camera cuts, inserts, video effects, closed captions, open captions, and so forth without decompressing and recompressing, then this issue should be revisited.

17. Compressed picture quality is even more critical when an event is recorded and played back in slow motion for close analysis, which is routine for sporting events. If a picture which is minimally acceptable in real time is shown in slow motion, the compression artifacts become glaring. Heavy compression of fast-motion pictures coming into the production facility, if recorded and played back in slow motion, will display compression artifacts which would otherwise be hidden.

SBE Disagrees That Digital Video Signals Are "Far More Robust" Than Analog Signals

18. At Section C, Page 15, of its Petition, the MSS Coalition makes the claim that "a digital signal can be far more robust than an analog signal." However, this conclusion is only valid if the digital signal uses forward error correction. The problem is that for non-engineered paths, which ENG and sports events are faced with, the amount of such forward error correction becomes so large that the system throughput becomes impracticably small, to say nothing of latency problems. For engineered paths, where equipment size, weight, and power consumption are not critical factors, digital modulation techniques can result in greater spectrum efficiency. If such engineered paths were the only precluding problem for new MSS spectrum, the problem could be simply solved by MSS paying the cost for such new, and more efficient, digital equipment for all existing BAS licensees. But the MSS Coalition's ignoring inconvenient facts does not make them go away. Those facts are that most 2 GHz BAS users employ non-engineered paths and many involve mobile and portable equipment where size, weight, and power consumption are critical parameters. Until the MSS Coalition can adequately address these critical issues, it has no business pointing its finger at the Commission or broadcasters.

Latency Problems

19. Digital compression takes time. As digital pictures wind their way through a compressor they are delayed, by significant fractions of a second to over one second. The heavier the compression, the longer it can take, because the algorithm is more complex. Since digital transmission by RF in reasonable bandwidth cannot occur without compression, the delay, or latency, factor becomes important. If some cameras at a fast-moving event are wired (*i.e.*, uncompressed), and others are RF cameras, as is typically the case, either the wired cameras must all be digitally delayed to match the RF cameras or the RF cameras will be noticeably lagging the event. In an interview or discussion program where some parties are in the studio and others are brought in from remote locations, the latency of digital

compression tends to make the "remote" parties (such as a state governor at the capital) look silly because they are always lagging behind the studio parties in responding. Broadcasters need to avoid this; apparently the MSS Coalition would rather save money.

Frequency Coordination Problems

20. The MSS Coalition has proposed that ENG spectrum be carved up into channels of varying bandwidth to allow the use of analog or digital equipment (Petition at Page 16, and Exhibit A at Pages 12-13). Such a plan would simply make agile spectrum sharing and real-time coordination impossible because the channels would no longer be interchangeable. Borrowing channels would become much more difficult, thus fostering an absolute requirement for more channels to handle the resulting less efficient use of available spectrum.

21. The MSS Coalition discusses multiple users operating into one satellite transponder (Exhibit A, Page 5). This is only possible in one of two ways. The data streams may be combined at one uplink site, for maximum efficiency (which is not possible from ENG vans located at different sites). If not, because separate uplink sites are used, at least the power levels are controlled to be very similar at the transponder, to prevent one signal from disrupting the other signal. This is possible because uplinks are controlled by the satellite operator through communication with the uplink operator. In BAS terrestrial operations, there is no such common controller. Each station maintains its own fixed receive locations, based upon competitive and other considerations. Further, temporary receive sites are regularly used, especially for miniature cameras used in sporting evens and covert camera news gathering. SBE would be very interested to hear an explanation of how power levels of miniature transmitters in race cars, traveling at 100 to 200 miles per hour, with path attenuation constantly changing, could be controlled to produce constant signal levels at receivers in a hovering helicopter; by the time a command could be sent, it would already be too late. The inability to control relative power levels at the receiver in real-world terrestrial operations makes channel sharing much more difficult than in a simple fixed satellite operation.

22. Finally, excessive congestion in 2 GHz BAS operations has the potential to disrupt World space operations. Only in the United States is the 1,990–2,110 MHz band primarily allocated to BAS. In the rest of the world, space operations are primary. U.S. space programs operating in the 2 GHz BAS band include the Hubble Space Telescope and the Space Shuttle; other nations operating in this band include Japan and Europe. Broadcasters in the U.S. have successfully coexisted with U.S. space operations since before the Mercury

program, and would prefer to continue doing so. However, increased terrestrial spectral density in this band could disrupt space programs of multiple nations, and not just U.S. space missions[9]. Before severe changes are mandated in transmission modes in the 2 GHz BAS band, SBE believes that it would be wise to make tests, in cooperation with NASA, to determine the impact of such changes on such space missions, lest the U.S. disrupt not only its own vast investment in orbital hardware but that of the rest of the world as well.

Summary

23. The Commission should reject the MSS Coalition's Petition. It attempts to re-argue issues already properly decided in the First Report and Order. Many of the technical claims are flawed. The record in this proceeding is well-developed, and the Commission's decision was a reasoned one.

Respectfully submitted,

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[9] ITU Recommendation ITU-R SA.1154.

CERTIFICATE OF SERVICE

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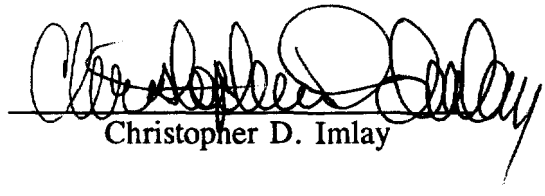

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